

# Digital slides integration in electronic health record

## EURO-TELEPATH. Telepathology Network in Europe

### COST Action IC0604

Start date: 05/11/2007

End date: 05/11/2011

Year: 3

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Chair

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Vice-Chair

Hospital do Espiritu Santo - Évora / Portugal





# Scientific context and objectives

- **Research directions:**
  1. **Automation procedures** in Pathology. Best technology available and under research.
  2. Scanning solutions for Pathology microscopic slides.
  3. Technological solutions for **compression and storage** problems with large image files.
  4. Virtual slide standard viewer specifications which allow efficient reviewing of pathology images.
  5. International standards (DICOM, HL7, SNOMED, CEN) and IHE initiative.
  6. **Model for pathology** and other hospital information systems
  7. An **European-scope telepathology** network
  8. Collection of interesting and typical samples, and clinico-pathological sessions

# Working groups



4 Working Groups	Coordinators
<p>WG1. Pathology Business Modelling  <i>e.g. Consensus study of existing workflows in pathology departments</i></p>	<p>Thomas Schrader (Germany) and Luis Gonçalves (Portugal)</p>
<p>WG2 – Informatics Standards in Pathology  <i>e.g. Participation in covered standards bodies and initiatives.</i></p>	<p>Christel Le Bozec (France) and Bernd Blobel (Germany)</p>
<p>WG3 – Images: Analysis, Processing, Retrieval and Management  <i>e.g. study on the image analysis models (methods, systems, tools, fields of pathology).</i></p>	<p>Janina Slodkowska (Poland) and EPFL (Switzerland)</p>
<p>WG4 – Technology and Automation in Pathology  <i>e.g. analysis of microscope brands.</i></p>	<p>Marcial García Rojo (Spain) and Bernd Blobel (Germany)</p>

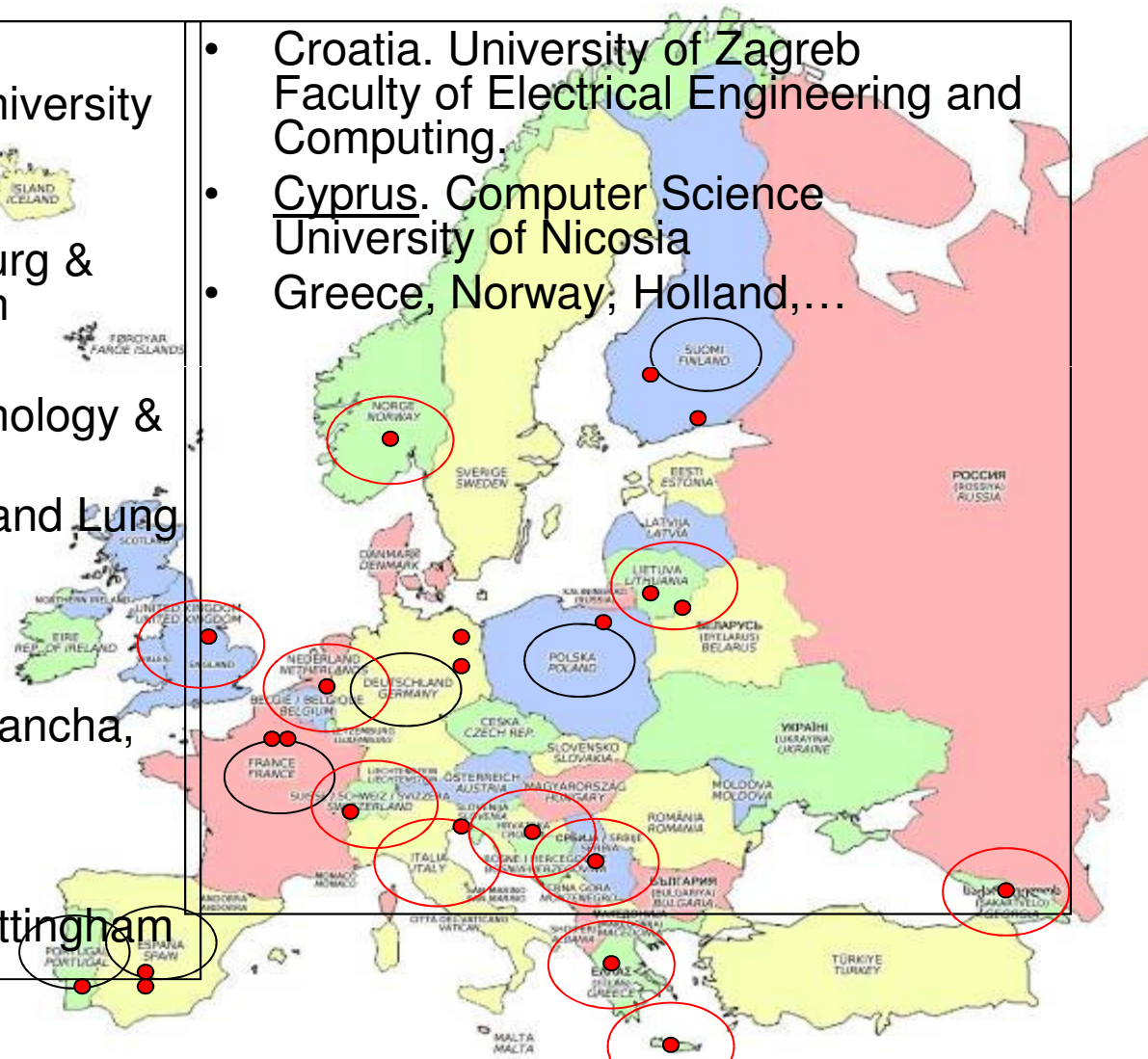
# Current research groups

Policy: A group of researchers (balance of female & young experts aged less than 35), shall be duly appointed to encourage and coordinate the network's efforts.

## Action SIGNATURES

1. Finland: Tampere University & University of Helsinki
2. France: INSERM & Tribvn
3. Germany: University of Regensburg & Charité Universitätsmedizin Berlin
4. Italy: University of Udine
5. Lithuania: National Centre of Pathology & Kaunas University of Technology
6. Poland: Institute of Tuberculosis and Lung Diseases, Warsaw
7. Portugal: Hospital Espirito Santo
8. Serbia: University of Belgrade
9. Spain: University of Castilla-La Mancha, Hospital General de Ciudad Real & SESCAM
10. Switzerland: EPF Lausanne
11. United Kingdom: University of Nottingham

- Croatia. University of Zagreb Faculty of Electrical Engineering and Computing.
- Cyprus. Computer Science University of Nicosia
- Greece, Norway, Holland,...

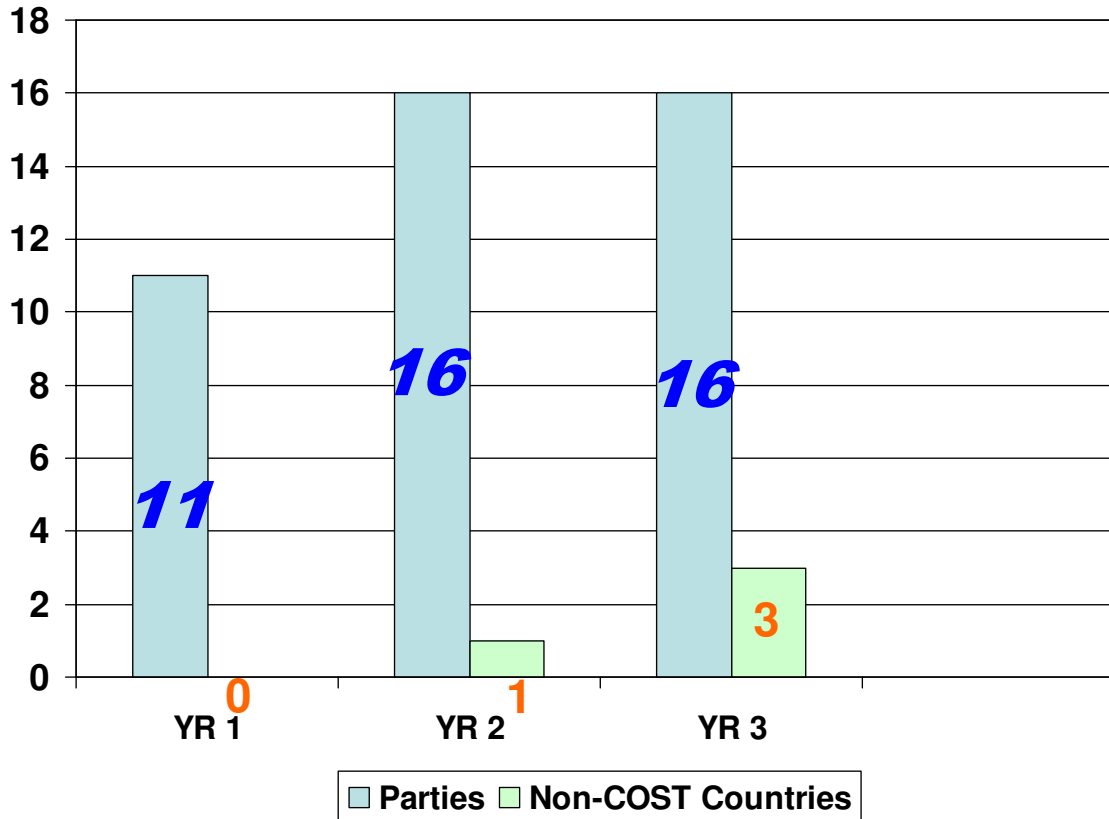


# Partners' background

Action kick-off		Clinical	Pathology	ICT	Industry
1.	<u>Finland</u> : Tampere University & University of Helsinki	●	●	●	
2.	<u>France</u> : INSERM & Tribvn		●	●	●
3.	<u>Germany</u> : University of Regensburg & Charité Universitätsmedizin Berlin		●	●	●
4.	<u>Italy</u> : University of Udine			●	
5.	<u>Lithuania</u> : National Centre of Pathology & Kaunas University of Technology		●	●	
6.	<u>Poland</u> : Institute of Tuberculosis and Lung Diseases, Warsaw	●	●		
7.	<u>Portugal</u> : Hospital Espirito Santo		●		
8.	<u>Serbia</u> : University of Belgrade			●	
9.	<u>Spain</u> : University of Castilla-La Mancha, Hospital General de Ciudad Real & SESCAM	●	●	●	
10.	<u>Switzerland</u> : EPF Lausanne				
11.	<u>United Kingdom</u> : University of Nottingham		●		



# Action Parties



## Grant Holder:

Foundation for Health Research in Castilla-La Mancha, FISCAM.

## GH Representative:

Marcial García Rojo

Spain

**Non-COST institutions:** WiPro tech, India; IPAL, Singapore; Georgian Telemedicine Union (Association)

# Industry involvement and standardization

- Tribvsn, France. SME
- Philips Healthcare, The Netherlands
- Barco
- SlidePath, Ireland, SME
- VICOMTech, Spain, SME
- Aurora MSC, SME
- SATEC, Spain
- Leica Microsystems, Germany
- COST Action IC0604 is highly involved with all standardization bodies related to medical informatics and Pathology, namely DICOM (images), JPEG (compression), HL7 (messages), IHTDS-SNOMED CT (terminology), and IHE (how to use standards).

# Results vs. Objectives

- **2008:** IHE workflow proposals can help increasing productivity and automation procedures. We started a analysis of Scanning solutions. Pathology DICOM object model was published.
- **2009:** JPEG is aware of compression and storage in Pathology. Image analysis of immunohistochemical quantification was evaluated
- **2010:** Process modelling notation based on BPMN was decided. IHE profiles were successfully tested by companies. Nanotechnology and multispectral imaging is being evaluated in Pathology.

# Significant highlights (1/2)



## 1<sup>st</sup> Nottingham Image Analysis Training School

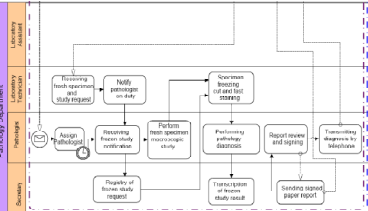
- 24-26th June, 2009
- 26 participants from 6 different countries
- 10 trainees benefited from fixed 500 Euros grants
- A successful multidisciplinary course with 15 medical doctors, 2 biologists, 10 engineers
- Proceedings published in COST Action IC0604 website
- Related STSM months later, also related with image analysis
- Second edition: June 27-29, 2010. Lithuania in dates close to the 10th European Congress on Telepathology and 4th International Congress on Virtual Microscopy was held in Lithuania

## Significant highlights (2/2)



- Workshop on “**Digital Pathology in Europe: Coordinating Patient Care and Research Efforts**”
- I.T. engineers, bioinformaticians, biologists, pathologists
- In conjunction with 22nd International Congress of the European Federation for Medical Informatics.
- A productive discussion on handling whole slide microscopy images in PACS was established.
- The collaborative studies on breast carcinoma (HER2/neu and hormonal receptors) and neuroendocrine cells in chronic gastritis were the main output of this meeting.

# Challenges



- The planned number of STSM was achieved, but we should improve the **participation of young scientists** in this field.
- Next critical phases should include:
  - Including the business process model we have created in standards documents (e.g. IHE integration profiles).
  - Terminology: SNOMED CT for Anatomic Pathology
  - Standardization in image automatic analysis
  - Improving quality of images in whole slide imaging platforms

# Short Term Scientific Mission (STSM)



- **Italy.** University of Udine → SESCAM, Toledo (ES)
- **France** (François Baclesse Cancer Center, Caen) → Utrecht (NL)
- **Spain.** Hospital Vall d'Hebron → Univ. Charite, Berlin(DE)
- **Germany.** Univ. Charite, Berlin → UCLM, Ciudad Real (ES) X2
- **Poland.** Institute of Biocybernetics and Biomedical Engineering, Warsaw → Hospital Virgen de la Cinta de Tortosa (ES) x 2

# Scientific Papers publication

## Standards to Support Information Systems Integration in Anatomic Pathology

*Christel Daniel, MD, PhD; Marcial García Rojo, MD, PhD; Karima Bourquard, PhD; Dominique Henin, MD, PhD; Thomas Schrader, MD; Vincenzo Della Mea, PhD; John Gilbertson, MD; Bruce A. Beckwith, MD*

● **Context.**—Integrating anatomic pathology information—text and images—into electronic health care records is a key challenge for enhancing clinical information exchange between anatomic pathologists and clinicians. The aim of the Integrating the Healthcare Enterprise (IHE) international initiative is precisely to ensure interoperability of clinical information systems by using existing widespread industry standards such as Digital Imaging and Communication in Medicine (DICOM) and Health Level Seven (HL7).

**Objective.**—To define standard-based informatics transactions to integrate anatomic pathology information to the Healthcare Enterprise.

**Design.**—We used the methodology of the IHE initiative. Working groups from IHE, HL7, and DICOM, with special interest in anatomic pathology, defined consensual technical solutions to provide end-users with improved access to consistent information across multiple information systems.

**Results.**—The IHE anatomic pathology technical framework describes a first integration profile, “Anatomic Pathology Workflow,” dedicated to the diagnostic process including basic image acquisition and reporting solutions. This integration profile relies on 10 transactions based on HL7 or DICOM standards. A common specimen model was defined to consistently identify and describe specimens in both HL7 and DICOM transactions.

**Conclusion.**—The IHE anatomic pathology working group has defined standard-based informatics transactions to support the basic diagnostic workflow in anatomic pathology laboratories. In further stages, the technical framework will be completed to manage whole-slide images and semantically rich structured reports in the diagnostic workflow and to integrate systems used for patient care and those used for research activities (such as tissue bank databases or tissue microarrays).

*(Arch Pathol Lab Med. 2009;133:1841–1849)*

# Digital slides integration in electronic health record. We need...

- Multidisciplinarity: Collaboration between Informaticians, engineers, pathologists, technicians, clinicians, primary care, administrators...
- Think global: Solutions for department but with a scope comprising hospital, regional, national, european, and international levels.
- Standards are emerging, but can we talk about real interoperability?



**Hospital de Ciudad Real**

Localización de pacientes

→ lastsearch

**Agendas Consultas ETM**

Est. trabajo médica

Informes del paciente

**Nuevo pedido**

Creación de documentos

Puesto de citación

Preferencias

Ayuda

Cambiar Perfil/Hospital

Cambiar Unidad Enf.

Salir

Varón, 55 años

**Problemas y episodios**

	Seg	Tipo	Código	Descripción	O	Esp/Serv	Fecha	Médico Responsable	Transcriptor	Hospital	E	I	A
<input checked="" type="checkbox"/>			1065245252	[Sin descripción]		DIG2	28/04/2008			HCR			
<input type="checkbox"/>			1065237378	[Sin descripción]		DIG1	07/11/2007			HCR			
<input type="checkbox"/>			1065205430	[Sin descripción]		ANRA	23/10/2007			HCR			
<input type="checkbox"/>			1062883369	[Sin descripción]		DIG2	22/06/2007			HCR			

Patología - Microsoft Internet Explorer provided

Archivo Edición Ver Favoritos Herramientas Ayuda

Dirección <http://e-pat.hgcr.sescam.jcm.es/default2.htm>

**e-PAT** Buscar Paciente

**e-PAT**

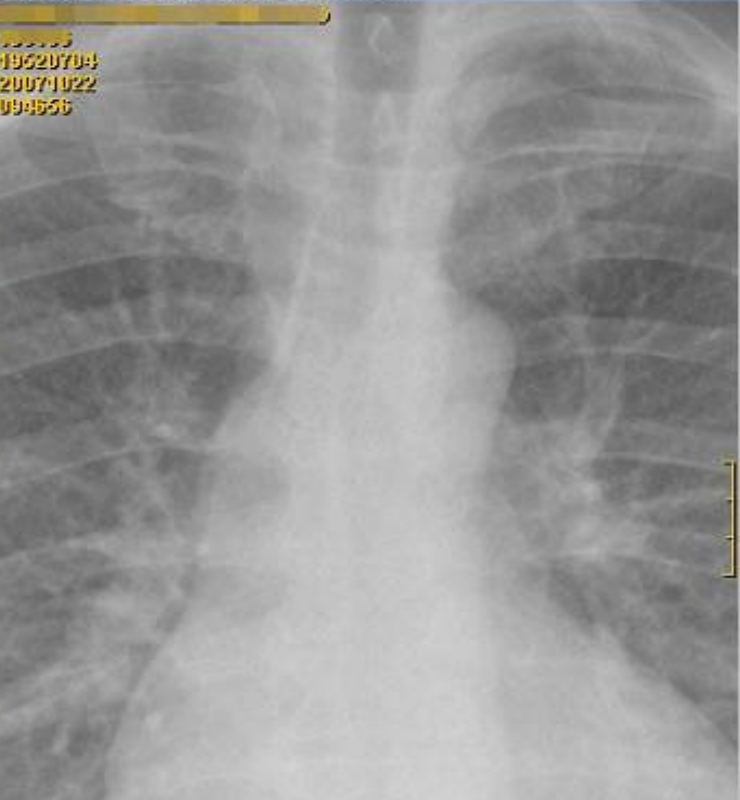
Peticiones y resultados web para Anatomía Patológica

Estudios para el Paciente Visualiza

Número	Tipo de estudio	Tipo de proceso
<b>0780</b>	<b>BIOPSIA</b>	<b>NORMAL</b>
<b>0780</b>	<b>BIOPSIA</b>	<b>NORMAL</b>

**RAIM Java (DICOM Java Viewer)**

19520704  
20071022  
094556



1 of 1

Navigation and zoom controls:

- Left arrow, Right arrow
- Home, End
- Zoom in, Zoom out, 1:1
- Hand, Refresh, Reset
- 90°, 0°, 270° rotation, Print, Save

W: 60000 L: 30000

wOrig wAuto

Serendipia :: Microsoft Internet Explorer provided by HOSPITAL GENERAL DE CIUDAD REAL

Archivo Edición Ver Favoritos Herramientas Ayuda

Atrás Avanzar Detener Búsqueda Favoritos

http://10.50.0.171-0099/serendipia/ssi/TrayectoriaActividad

Currente - SSCC SSCC PUBLIC SSCC


Serendipia

sercam  
Servicio de Salud Castilla-La Mancha


Recurso: HOSPITAL GENERAL DE CIUDAD REAL

Digitalización Informes Discusión Formación Desconexión


**Digitalización**



Macroscopía




Microscopio




Preparaciones virtuales


**Discusión**




Consultar Casos HCR




Consultar Foro Público




Consultar Sesiones Clínicas




Temas



Nueva Consulta 2ª Opinión




Nueva Consulta Pública




Nueva Sesión Clínica

**Informes**




Consulta Informes


**Formación**




Nuevo Caso de Interés



Consultar Biblioteca



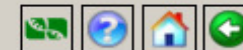
Nuevo Examen



Consultar Exámenes

Lista Local Intranet





DATOS DE LA MUESTRA



Estudio B09-80

Tipo de Estudio

Valoración

Macro Micro Di

Realizada por

Ver Imágenes Micro y Virtual Slide

Filtrar Muestra

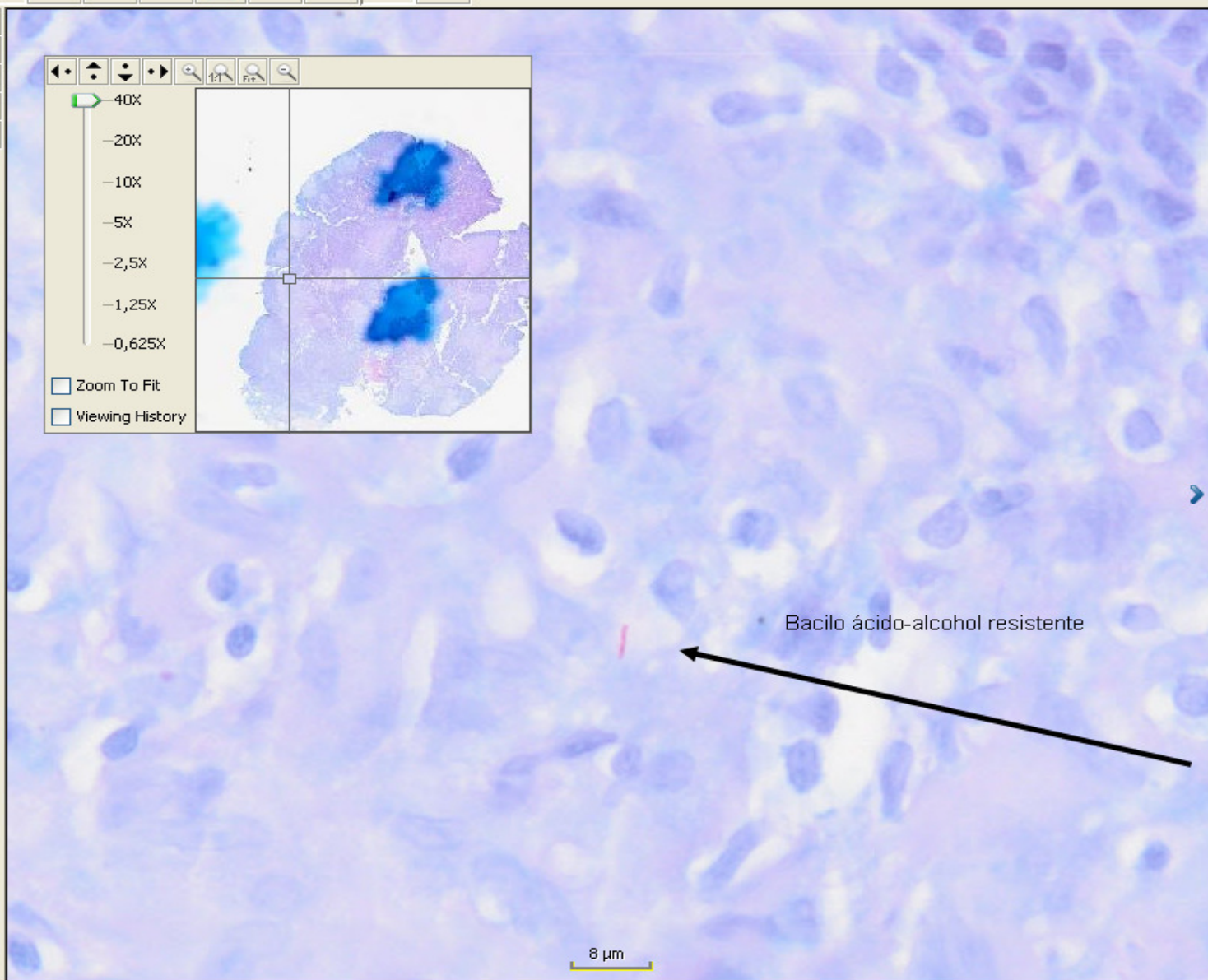
Muestra	Bloque	Porta	Fecha	Modalidad	Máquina	Estado
A	1	4	03/11/2009	Micro	Maquina 1 Micro - Lab 0	Pedidas
A	1	7	03/11/2009	Virtual Slide	Maquina 1 VSlide - Lab 0	Pedidas
A	2	10	03/11/2009	Virtual Slide	Maquina 1 VSlide - Lab 0	Pedidas
A	2	12	03/11/2009	Virtual Slide	Maquina 1 VSlide - Lab 0	Pedidas
A	2	13	03/11/2009	Virtual Slide	Maquina 1 VSlide - Lab 0	Pedidas

Seamless integration with LIS-Pathology Information system in a web environment  
View gross pictures and digital slides



40X  
20X  
10X  
5X  
2,5X  
1,25X  
0,625X

Zoom To Fit  
 Viewing History



### Collaboration

admin

#### Collaboration Users

patologo

**Public**

Note that any messages you type in the public chat tab can be viewable by any other user viewing the same media.viewier.media=Media

**(23:27:29) patologo:**  
This is the only acid-fast bacillus we could find in this biopsy

Properties  
Attributes  
Colour  
Collaboration (1)  
Annotations

Annotation Editing

# SNOMED CT in Pathology

- Spain became member of IHTSDO in 2008
- Spanish companies have very little experience in SNOMED CT implementation (they only think about coding).
- Local codes are very frequently used
- Is it worthwhile migrating the previous reports from SNOMED II a SNOMED CT?

# SNOMED CT in telepathology

Telepathology Web Portal of Castilla-La Mancha

## o Second opinion – Coding Topographics and diagnoses

Bienvenido Juan Herrero Herrera (Hospital Manzanares)

Digitalización	Solicitudes	Informes	Discusión	Formación	Desconexión
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Casos HMA  
 Consulta pública  
 Consulta 2ª Opinión  
**Foro Discusión**  
 Temas

**Filtrado de casos**       

  
 Coordinados por mí

[Nuevo Caso de interes](#)   
 [Nueva Consulta pública](#)   
 [Nueva Consulta 2ª Opinión](#)

Tema	Mensajes	Último mensaje	Coordinadores
<a href="#">Citología cérvico-vaginal</a> Análisis de patologías de cérvix uterina	1	11/03/2008 14:16 por prueba	Patologo Uno Uno
<a href="#">Partes Blandas</a> Análisis de patologías de partes blandas.	1	01/04/2008 15:58 por prueba	Juan Herrero Herrera

# Integration, what to do next

- At the user level: User identification once is achieved. Digital signatures not achieved
- At patient level: We can work with the same patient in different applications, and working with the same episode or visit. Problems oriented integration is not achieved.
- At the semantic level very little is achieved.
- Knowledge management

# Barriers to digital pathology adoption

# Scanning technology

- If speed and quality needs are reached, then glass slide step can be skipped.
- Increase automation in Lab workflow
- Now, many manual steps:
  - Embedding → Cutting → Staining → Permanent Mounting → Scanning → Reading → Store Glass slide
- In the future, all automated steps:
  - Embedding → Cutting → Staining → **Temporal** Mounting → Scanning → Reading → Store tissue slice only when needed. No glass slide production

# Conclusions:

- Solutions for current barriers (financing, cost per digitized slide) are possible.
- Pathology LIS is the core where all others system (image, lab workflow) must converge
- Standards (image, messaging, terminology) are working together with the only cooperation at individual level
- Participation in design. Clinicians are also users of our systems